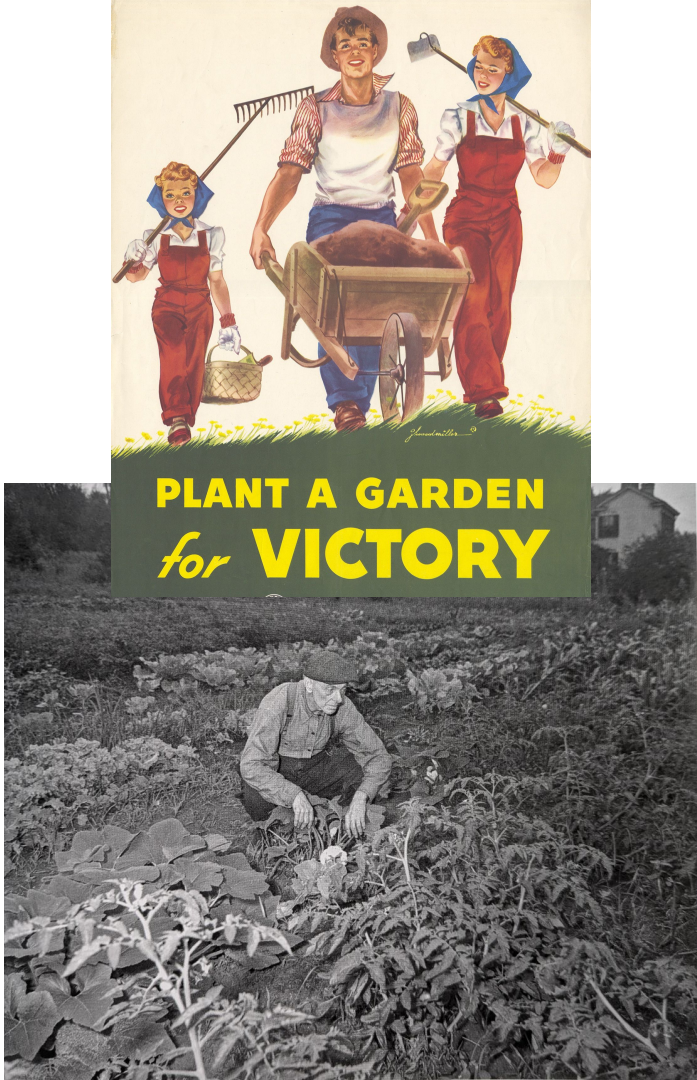
# Urban soil screening for safety, remediation, and grower empowerment

# Why urban agriculture

- Centuries old tradition of growing in cities
  - People will grow here anyway
- Urban growers are largest segment of new and beginning growers in USA
- Urban sites are great for learning and incubating growing skills before scaling up
  - Bridging rural and urban spaces
  - Strong transition and succession opportunities and potential to larger peri-urban, suburban, or rural spaces

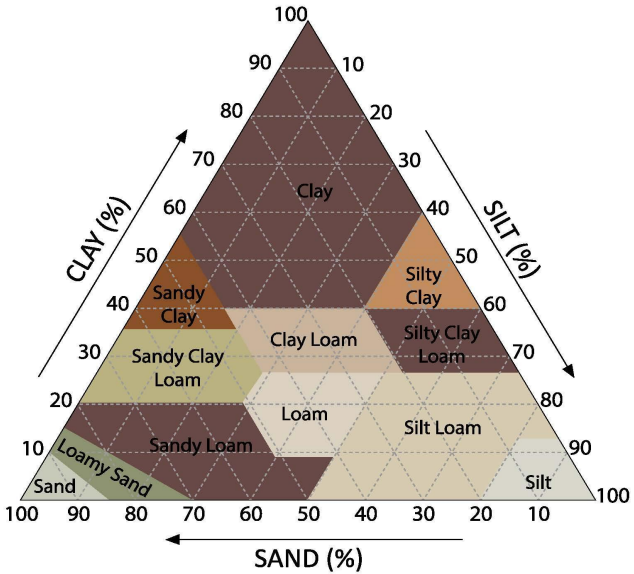


# Why urban soils

- Growing in-ground allows
  - Intensive production
  - Use of production-scale farming tools
  - Use of scalable growing techniques and appropriate analog for larger systems
- Soils are more resilient, and require less day-to-day support
- Ecosystem services
  - 1% organic matter increase can result in 20,000 gallons of water stored
- Less capital and carbon intensive than other growing systems








## Chemical

Examples of chemical characteristics include: pH, Nutrient content, acidity, and salinity.

## Physical

Examples of physical characteristics include: texture, compaction/pore space, and parent material.

## Biological

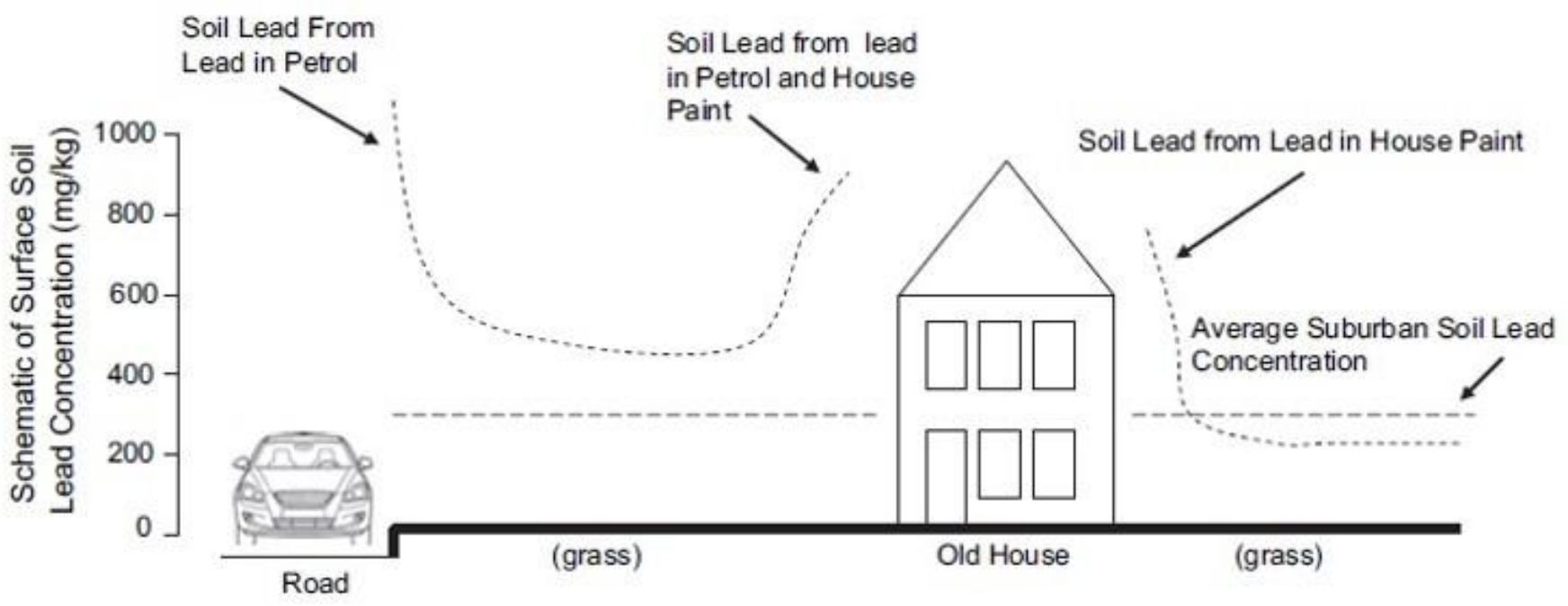
Examples of biological characteristics of soil include: microbial activity or soil biota.

# Common challenges of urban soil

- **Compaction**
  - From demolitions, foot traffic, loss of organic matter
  - No air space = no rain water infiltration
  - Harbors invasive species - bindweed, knotweed, poison ivy, mile-a-minute
- **Rubble filled**
  - Bricks, concrete, glass
- **Potential heavy metals contamination**
  - Lead - From gasoline and paint, pre-1979, etc.
  - Arsenic - Lumber treatment on decks and exterior wood
  - Chromium, cadmium - From industrial legacy use


BIG'S
724
379-4331

# Typical Soil Lead Distribution



# What is XRF?


Viewing Screen
Detector
Processor
X-ray Tube
OLYMPUS
DELTA


OLYMPUS

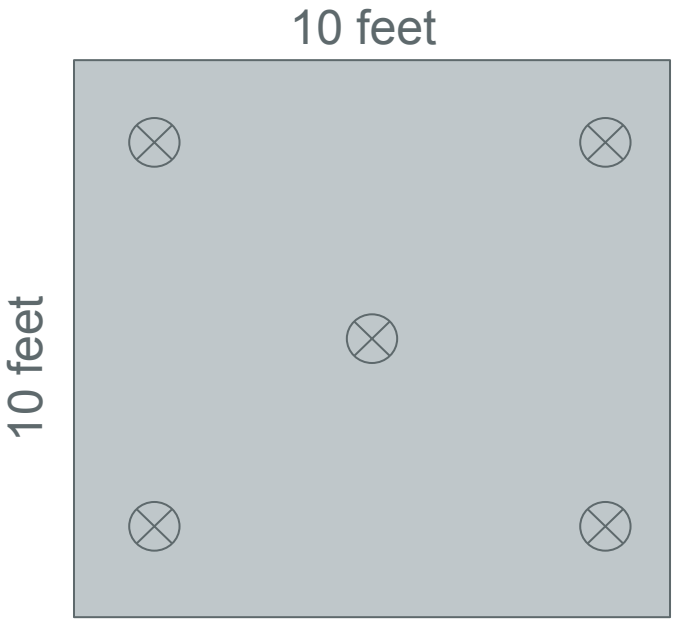
2004

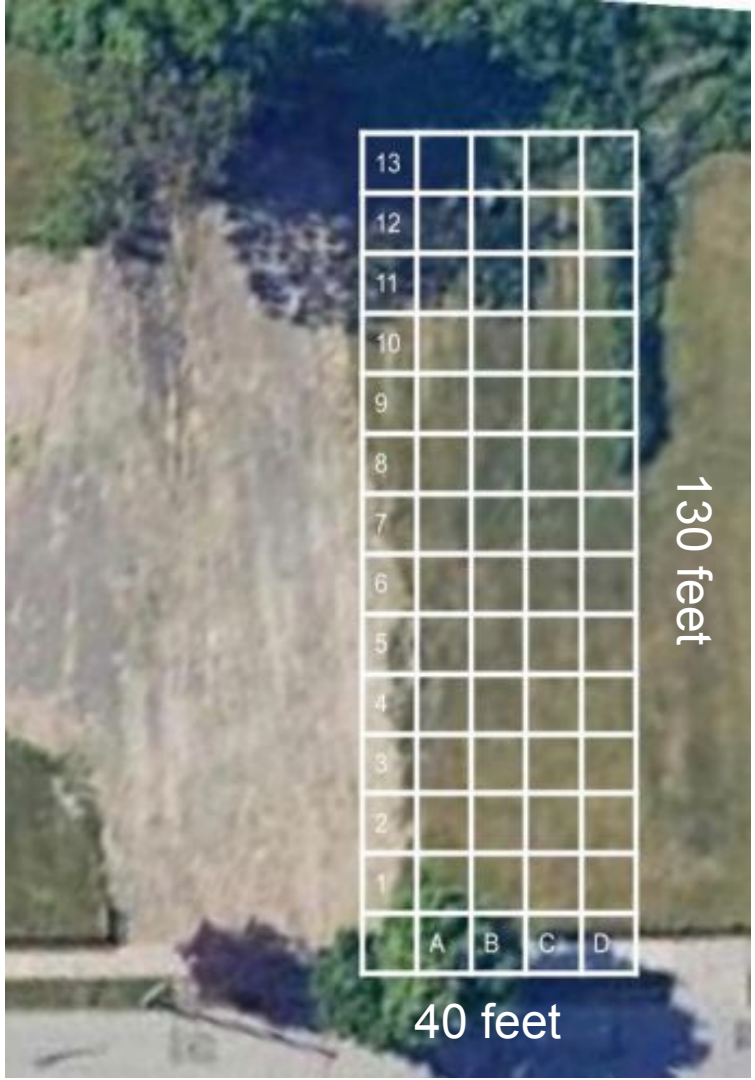


2005



# Geolocated grid sampling







**HIGH RISK: 1,000+ PPM**
Do not garden in soil with contamination in this range. Keep children & pets away from areas with bare soil & take steps outlined in other risk categories to reduce dust & in-ground lead mobility. Keep the area covered. If lead contamination exceeds 2,000 ppm, contact your local health department, Penn State Extension office, or regional DEP office for specific advice on lead abatement measures that should be taken.

**MEDIUM RISK: 401- 1,000 PPM**
As lead moves from the higher end of low risk into medium risk, working in the soil becomes more difficult. At a medium risk level in-ground gardening of leafy greens and root crops should be moved to raised beds with clean soil. Covering the ground with mulch or thick turf can also help by reducing the presence of dust.

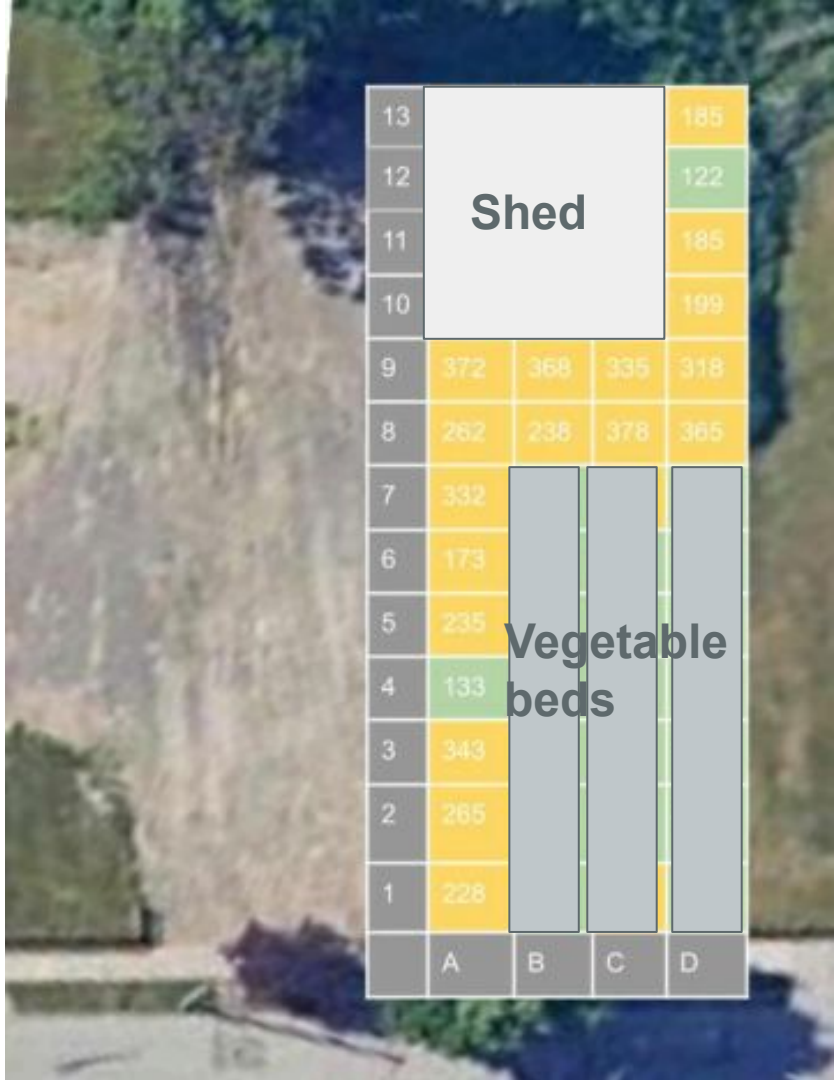
**LOW RISK: 151- 400 PPM**
At this range of risk, it is important to make sure that people (especially children) interacting with soil thoroughly wash their hands and keep shoes at or near the door to avoid bringing dust indoors. When gardening in this soil, wash all produce thoroughly, make sure pathways are covered to reduce dust, & place garden beds away from roads, driveways, & old painted structures.

**VERY LOW RISK: 0- 150 PPM**
This is the range of lowest risk, but because we understand that lead contamination occurs on a continuum, it is important to make sure a "clean hands policy" is always used.

*There is no single threshold that defines acceptable levels of lead in soil. The chart above indicates the degree of risk associated with various soil lead concentrations utilized by the City of Pittsburgh.




13 861 581 519 185
12 944 719 732 122
11 509 879 310 185
10 564 461 542 199
9 372 368 335 318
8 262 238 378 365
7 332 101 249 104
6 173 111 86 62
5 235 99 68 67
4 133 69 74 105
3 343 46 53 85
2 265 66 64 85
1 228 97 159 134
A B C D


13 185
12 122
11 185
10 199
Shed
9 372 368 335 318
8 262 238 378 365
7 332
6 173
5 235
4 133
3 343
2 265
1 228
Vegetable beds
A B C D

# Approaches to Contaminated Soils

1. **Cap and build up**
   - Raised beds with new growing media
   - Create a continuous barrier layer over contaminated soils
   - Moderate to high cost
2. **Remove and replace**
   - Full removal of contaminated soils and replacement with new material
   - Very high cost
3. **Dilute and immobilize**
   - Moderate to high management
   - Lower cost
   - Useful at lot and field scale



# Road map and BMP's for next steps

- Scoop dump
- Organic matter application
- Re-testing on geolocated grid
- Ongoing management of:
  - pH
  - Organic matter levels
  - Living cover
  - [Phosphorus levels]

- Soil Health Benchmark Study
  - Plugging into network of growers
  - Urban ag cohort
- Community composting school
- Cover crop trials for nutrient cycling and biomass building



# Comprehensive Assessment of Soil Health (CASH)

Measured Soil Textural Class: **silt loam**
Sand: **20%** - Silt: **53%** - Clay: **27%**

| Group | Indicator | Value | Rating | Constraints |
|---|---|---|---|---|
| *physical* | Predicted Available Water Capacity | **0.25** | **92** | |
| *physical* | Surface Hardness | | | No Field Readings Submitted |
| *physical* | Subsurface Hardness | | | No Field Readings Submitted |
| *physical* | Aggregate Stability | **34.9** | **59** | |
| *biological* | Organic Matter<br>Soil Organic Carbon: 3.7 / Total Carbon: 3.7 / Total Nitrogen: 0.17 | **4.9** | **98** | |
| *biological* | ACE Soil Protein Index | **6.8** | **54** | |
| *biological* | Soil Respiration | **1** | **92** | |
| *biological* | Active Carbon | **541** | **59** | |
| *chemical* | Soil pH | **6.3** | **98** | |
| *chemical* | Extractable Phosphorus | **5.6** | **100** | |
| *chemical* | Extractable Potassium | **233.8** | **100** | |
| *chemical* | Additional Nutrients<br>Ca: 2023.1 / Mg: 171.4 / S: 11.1<br>Al: 17.5 / B: 0.27 / Cu: 0.28<br>Fe: 1.2 / Mn: 7.7 / Zn: 4.7 | | **100** | |

Overall Quality Score: **85** / Very High

# Side-by-Side Cover Crop Trials







# Questions ?







# Thank you

Pasa SUSTAINABLE AGRICULTURE